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AN ANALYTIC APPROACH TO ESTIMATING THE GENERALIZABILITY OF TANK CREW PERFORMANCE OBJECTIVES

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UNIT TRAINING AND EVALUATION SYSTEMS TECHNICAL AREA

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AN ANALYTIC APPROACH TO ESTIMATING THE GENERALIZABILITY OF TANK CREW PERFORMANCE OBJECTIVES

INTRODUCTION

The Army program for gunnery training and tank crew evaluation is defined by gunnery tables, consisting of several training or testing exercises in which crews engage targets under various conditions. Crews progress through the exercises listed in Tables I through VII and reach successful completion of the gunnery exercises in Table VIII.

The gunnery tables are developed by experienced Armor personnel who distill the essence of tank gunnery into a manageable set of training and testing exercises. Gunnery tables are developed for each Armor weapon system that has significant differences in firing capability, and are continuously revised to reflect changes in equipment and doctrine. Additional impetus for revising the gunnery tables is provided by the Army's commitment to increase both combat readiness and efficiency in training and evaluation.

Extensive efforts to improve the efficiency of tank crew training evaluation are underway. In addition to ongoing TRADOC and FORSCOM studies, a long-range program of research has been initiated by the U. S. Army Research Institute. Numerous issues are being investigated, including methods of defining and measuring the performance domain of tank gunnery, the use of simulation devices as a replacement or complement to live firing, and the type of practice schedule required to develop and maintain required levels of proficiency. As part of this programmatic effort, a project is underway to develop a more efficient Table VIII test for M60A1AOS crews. The first of a series of studies toward this goal describes performance objectives in the gunnery domain in terms of their potential generalizability: the extent to which performance on one item predicts performance on others.

Generalizability is an important consideration in tank crew training and evaluation. The gunnery performance domain which tank crews must master is considerable. A recent study reported by Kraemer, Boldovici and Boycan (1976)* resulted in a list of 225 performance objectives, and defined all possible ways that targets could be neutralized with M60A1AOS weapons. Each objective represents a unique set of procedures to be applied by the tank crew, with the environmental and tactical conditions under which such procedures are appropriate. For example, "Given a stationary M60A1AOS and a moving tank type target of less than 1600 meters either day or night, the crew will engage, using a battlesight method of fire and the gunner's periscope." In view of the practical constraints of

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* Kraemer, R.E., Boldovici, J.A., and Boycan, G.G. Job Objectives for M60A1AOS Tank Gunnery. Research Memorandum 76-9. U.S. Army Research Institute for the Behavioral and Social Sciences. April 1976.

time, range facilities and costs associated with live ammunition, crews cannot be provided the opportunity to practice and subsequently demonstrate proficiency on all such performance objectives. Therefore, an optimal subset must be identified. In the case of evaluation, this subset should consist of objectives which minimize the risk of misclassification - that is, either passing crews who are really not qualified, or failing crews who are qualified.

Traditional empirical item-analysis methods were not feasible for this project because of the resources required to obtain repeated measures on all tasks in the gunnery domain. In lieu of establishing item generalizability empirically with livefire data, an alternative analytic approach had to be used.

The validity of the approach rests on the assumption that the more task elements or behavioral steps that any performance objective has in common with other objectives, the greater the communality among those objectives. Furthermore, the greater the communality, the greater the probability that performance on the one objective is predictive of performance on others. Suppose, for example, that it could be demonstrated that firing the main gun using the precision method has more task elements in common with firing the main gun battlesighted than with firing the coaxial machine gun. The assumption is that because of this greater communality, the precision main gun task is more predictive of the battlesighted main gun task than of coaxial machine gun performance.

TECHNICAL APPROACH

The basic approach used to establish communality among performance objectives in the tank gunnery domain is shown in Figure 1. Objectives were listed down the left column of a large matrix. Task elements were then listed across the top. Examples of task elements are, "Loader announces 'up'," "Gunner indexes HEP" and "Gunner levels bubble." A'1' or an '0' was then entered under each task-element in the row for each objective, indicating that performance of the objective did or did not require performance of each of the task elements. The matrix was completed in this manner for 240 objectives and a total of 113 task elements.

Certain "system state" assumptions had to be made early in the analysis in order to achieve consistency in specifying which task elements were and were not included in each objective. If, for example, the weapons were assumed to be loaded, different task elements would be involved than if the weapons were assumed to be unloaded.

Performance Objective	Task Element 1	2	3	4	5	6	7	8	9	10	11	12	...	n
1	1	1	1	1	1	0	0	0	0	0	0	0		
2	1	1	1	1	1	1	1	1	0	0	0	0		
3	1	1	1	1	0	0	0	0	1	1	1	1		
.														
.														
240														

Figure 1. Concept of the data matrix.

CLUSTER ANALYSIS OF THE OBJECTIVES

The first question in analyzing the matrix of 240 performance objectives by 113 task elements was whether subsets or "families" of objectives, those that had many task elements in common, could be identified. If relatively homogeneous families of objectives could be identified, the problem of assessing generalizability of each objective could be simplified. Rather than estimating generalizability of each objective for 240 objectives, generalizability could be determined for a much smaller set of objectives. Representation of the entire domain of gunnery performance objectives could then be insured by including the most generalizable objective(s) from each family.

Two cluster analyses were performed in an attempt to identify families of objectives. Both analyses began by calculating the "behavioral distance" between each pair of objectives. Many distance measures have been reported in the literature, but for the one-zero data in the objective-element matrix, most of these measures are equivalent. The simple matching coefficient (SMC) was used to measure behavioral distance in the present analyses. The SMC measures distance by the proportion of elements which are identical between each pair of objectives. Thus, for two objectives which have exactly the same values on 20 out of the 113 elements, the inter-objective distance is 20/113 or .117.

Use of the SMC produces a matrix that shows the behavioral distance between every pair of objectives. Objectives that are "close together" in behavioral distance form the clusters of objectives. The process is amalgamative, in that the two closest objectives form the seed for the first cluster. Nearby objectives are incorporated into this cluster until an objective is found which is too far away; this objective then forms the seed of a new cluster.

Two clustering algorithms which employ the SMC were considered. One of these, the Average Distance amalgamation algorithm, requires an assumption that the 113 behavioral dimensions are independent. Because this assumption seemed questionable, both this algorithm and another, the Direct Clustering algorithm* which does not require the independence assumption, were used. The Direct Clustering algorithm was used first, to test the independence assumption. The more typical Average Distance algorithm was then used as a check.

RESULTS OF THE CLUSTER ANALYSIS

The Direct solution indicated certain dependencies but did not rule out the Average Distance algorithm, so both were used as a pair of converging operations. The Direct cluster analysis yielded 26 distinct clusters; the Average Distance solution recast the 240 objectives into 34 separate clusters. To examine the similarity or degree of overlap between the two solutions, Venn diagrams were drawn to indicate how each job objective had been categorized by the alternative solutions. An example of the Venn diagram is presented in Figure 2. Each circle represents a set of objectives clustered by one of the analytic procedures. Clusters defined by the Direct solution are shown by solid lines. Clusters emerging from the Average Distance approach are shown by dotted lines. The numbers within clusters represent specific performance objectives.

The Venn diagrams permitted identification of clusters which overlapped or were interconnected. Eight cases were observed in which high-order clusters existed: containing a mix of clusters from each solution, and having no overlap with other higher-order clusters. These larger sets were referred to as families of performance objectives.

Table 1 summarizes the eight families which were isolated by their component clusters and objectives. The most compelling feature of Table 1 is the descriptive information provided for each family. These descriptions were obtained by examining each objective in a family to establish what it had in common with the other members. The consistency of the objectives in a family is all the more striking when one recalls that: 1) description was attempted only after the families had been identified; and 2) the descriptors used had not been included in the cluster analyses.

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* Dixon, W.J. BMDP: Biomedical Computer Programs. Berkely, California: University of California Press, 1975.

Hartigan, J.A. Direct clustering of a data matrix. Journal of the American Statistical Association, 1972, 67, 123-129

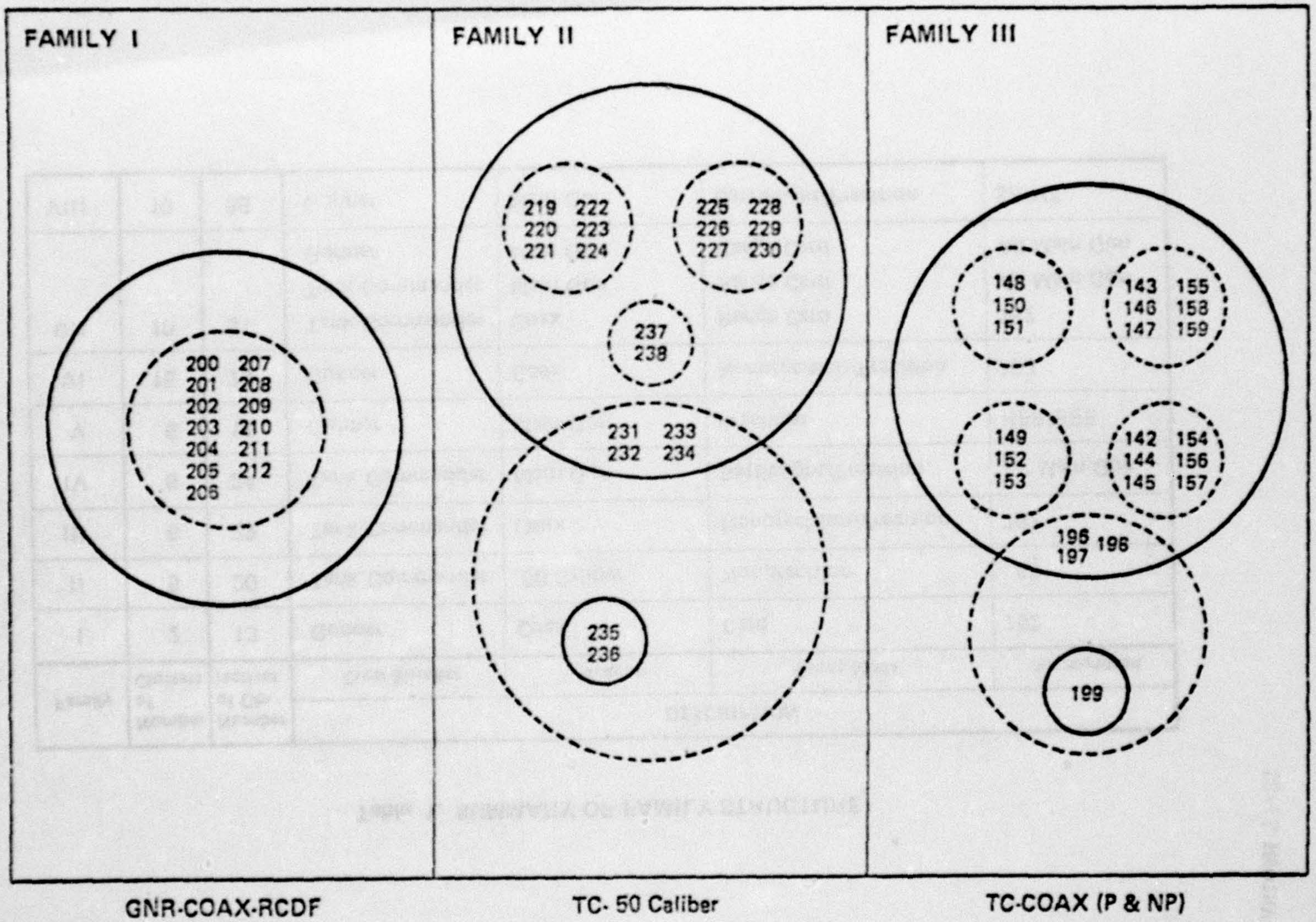

Figure 2. Venn diagrams defining families I, II, and III.

Table 1. SUMMARY OF FAMILY STRUCTURE

Family	Number of Clusters	Number of Objectives	DESCRIPTION			
			Crew Member	Weapon	Firing Mode	Ammunition
I	2	13	Gunner	Coax	Card	762
II	5	20	Tank Commander	.50 Caliber	Nonprecision	50
III	6	22	Tank Commander	Coax	Nonprecision/Precision	762
IV	6	24	Tank Commander	Main Gun	Battlesight/Precision	All Main Gun
V	6	16	Gunner	Main Gun	Precision	HEP/BEE
VI	15	78	Gunner	Coax	Nonprecision/Precision	762
VII	10	31	Tank Commander Tank Commander Gunner	Coax Main Gun Main Gun	Range Card Range Card Range Card	762 All Main Gun All Main Gun
VIII	10	36	Gunner	Main Gun	Battlesight/Precision	SB/HT

Table 2. Family V Objective-Element Matrix

Description		17 TC Announces Gnr	18 TC Announces Gnr, Whitelight	24 Driver Maintains Steady Speed	25 Driver Maneuvers Tank for Firing	26 Driver Announces Adverse Terrain	27 Driver Moves to Hull Down	28 Driver Brings Tank to Halt	29 Driver Locks Brakes	30 Loader Unlocks Ammo Ready Rack	34 TC Announces HEP	35 TC Announces BEEHIVE Time	42 TC Lays Gun for Direction	44 Loader Selects HEP	45 Loader Selects BEEHIVE	46 Loader Unloads Main Gun	47 Loader Loads Main Gun	48 Loader Places Main Gun Safety in Fire	51 Loader Announces HEP, Up	52 Loader Announces BEEHIVE, Up	53 Gunner Turns on Main Gun Switch	56 Gunner Indexes HEP or Coax	57 Gunner Indexes BEEHIVE	60 Gunner Selects HEP Reticle	61 TC Announces Target Description	64 Gunner Announces Identified	66 TC Announces Driver, Stop	67 TC Turns Off Computer	68 TC Ranges	69 TC Turns on Computer	70 TC Announces Range	71 Loader Sets BEEHIVE Fuze	14 Gnr Lays Crosshair at Center of Target	15 Gnr Lays Rangeline at Center of Target	16 Gnr Applies Aim-Off	35 TC Announces Fire	37 Gunner Relays on Target	38 Gunner Makes Final Precise Lay	43 Gunner Announces On the Way	45 Gunner Fires Main Gun
MS PRE S S B/C VI 5-32 D GPD HEP	49	X							X	X	X		X	X		X	X	X	X		X	X		X	X	X		X	X	X			X		X	X	X	X	X	X
MS PRE S S B/C VI 5-32 D TEL HEP	50	X							X	X	X		X	X		X	X	X	X		X	X		X	X	X		X	X	X	X			X		X		X	X	X
MS PRE M S B/C VI 5-32 D GPD HEP	51	X		X	X	X	X	X	X	X	X		X	X		X	X	X	X		X	X		X	X	X	X	X	X	X	X		X		X	X	X	X	X	X
MS PRE M S B/C VI 5-32 D TEL HEP	52	X		X	X	X	X	X	X	X	X		X	X		X	X	X	X		X	X		X	X	X	X	X	X	X	X			X		X		X	X	X
MS PRE S S B/C VA 5-32 N GPD HEP	53		X						X	X	X		X	X		X	X	X	X		X	X		X	X	X		X	X	X	X		X		X	X	X	X	X	X
MS PRE S S B/C VA 5-32 N TEL HEP	54		X						X	X	X		X	X		X	X	X	X		X	X		X	X	X		X	X	X	X			X		X		X	X	X
MS PRE M S B/C VA 5-32 N GPD HEP	55		X	X	X	X	X	X	X	X	X		X	X		X	X	X	X		X	X		X	X	X	X	X	X	X	X		X		X	X	X	X	X	X
MS PRE M S B/C VA 5-32 N TEL HEP	56		X	X	X	X	X	X	X	X	X		X	X		X	X	X	X		X	X		X	X	X	X	X	X	X	X			X		X		X	X	X
MS PRE S S TRP VI 5-32 D GPD BEE	57	X							X	X		X	X		X	X	X	X		X	X		X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X
MS PRE S S TRP VI 5-32 D TEL BEE	58	X							X	X		X	X		X	X	X	X		X	X		X	X	X	X		X	X	X	X	X		X		X		X	X	X
MS PRE M S TRP VI 5-32 D GPD BEE	59	X		X	X	X	X	X	X	X		X	X		X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
MS PRE M S TRP VI 5-32 D TEL BEE	60	X		X	X	X	X	X	X	X		X	X		X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X		X		X		X	X	X
MS PRE S S TRP VA 5-32 N GPD BEE	61		X						X	X		X	X		X	X	X	X		X	X		X	X	X	X		X	X	X	X	X	X		X	X	X	X	X	X
MS PRE S S TRP VA 5-32 N TEL BEE	62		X						X	X		X	X		X	X	X	X		X	X		X	X	X	X		X	X	X	X	X		X		X		X	X	X
MS PRE M S TRP VA 5-32 N GPD BEE	63		X	X	X	X	X	X	X	X		X	X		X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
MS PRE M S TRP VA 5-32 N TEL BEE	64		X	X	X	X	X	X	X	X		X	X		X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X		X		X		X	X	X

As further check on the integrity of the families, each was examined in terms of its behavioral elements. A typical outcome is shown in Table 2 for Family V - Gunner, Main Gun, Precision, HEP/BEE. Table 2 has two particularly salient features: First, only 39 of the total set of 113 elements are involved in Family V. Second, of these 39, 17 are possessed by every objective in the family. This patterning is typical of that found in all eight families: Only selected sets of elements apply to each family, and many of these elements are possessed by every objective in the family. It is the latter elements that primarily define a given family and distinguish it from others.

Based on these results, the strategy for selecting objectives for inclusion in a tank gunnery test would be to sample from the homogeneous objectives comprising each family. Because homegeneity is a highly relative concept, however, it can be argued that even greater homogeneity could be secured by subdividing families further on purely rational grounds. In Table 2 for example, one might further distinguish among the family V objectives in terms of those involving HEP and those involving BEEHIVE ammunition. When this is done, two subfamilies can be identified. The first, with objectives 49-56, contains 34 elements, 20 of which are common to all eight HEP objectives. The second or BEEHIVE subfamily, with objectives 57-64, contains 35 elements, 22 of which are common to all 8 objectives. The next step was to determine item generalizability.

GENERALIZABILITY ANALYSIS

The approach to estimating generalizability was based on the assumption that the more elements an objective had in common with other objectives, the greater the probability that performance on the one objective would be predictive of performance on the others. Two analogous indexes were developed to describe the generalizability of a given objective. One was used to express the generalizability of objectives in a given subfamily. The other index served a similar function at the family level.

The rationale for developing the generalizability index stemmed from the assumption that an objective consisting of elements occurring infrequently in the family or subfamily would not be as good a predictor of performance in that family as would another objective containing elements shared by many of the other objectives in the family. Because each objective has many elements, the contribution of each element to generalizability was weighted by its frequency of family occurrence (F) or frequency of subfamily occurrence (f). One can, however, look at these same elements in larger perspective. That is, the elements also distribute themselves across the domain, some cutting across many different families, while others are concentrated almost entirely in a given family. These latter elements serve to define the family. A parameter which takes this family-domain tradeoff into account was developed: F/D or f/D, where D is the

frequency with which a given behavioral element occurred in the 240 objectives comprising the gunnery domain. Each element is weighted multiplicatively for family frequency and inversely for its frequency in the domain relative to the family (e.g., F. F/D). More simply stated, elements contribute to generalizability in a family to the extent that they are relatively common in the family and relatively unique in the domain.

Index values were computed for each objective in a given family as follows: For each behavioral element comprising the family the F^2/D or f^2/D value was computed. For a given objective, these values were summed across the elements defining the objective.

RESULTS OF THE GENERALIZABILITY ANALYSIS

Generalizability index values represented estimates of the extent to which an objective permits generalizations about the family or subfamily of objectives from which it is drawn. The results are presented in Tables 3-5. Each table represents one of the eight families and when appropriate, constituent subfamilies. In each case, the code number and description of a performance objective in terms of 11 system variables is presented along with computed indexes of generalizability for the family and subfamily, if appropriate. Generalizability indexes, expressed in terms of z score equivalents, have been used to order objectives from most to least generalizable.

SUMMARY AND CONCLUSIONS

Generalizability is an important consideration in item selection, if test performance is expected to be predictive of performance on a larger domain. In this study, analytic means were used to estimate the generalizability of performance objectives which were candidates for inclusion in a tank gunnery test. Cluster analyses were conducted to identify subsets or families of objectives in the domain which were homogeneous in terms of behavioral elements. Then indexes of generalizability were computed to describe how generalizable a given objective was to others in its family. These analyses provided a useful framework for applying the criterion of generalizability during item selection.

The data base suggests including at least one objective from each of the subdomains that were identified. Given relatively limited resources, for example, the most generalizable objective from each of the eight major families would be included in the gunnery test. Given fewer constraints, the most generalizable objective from each of the 17 family or constituent subfamilies would be selected. Although multiples of eight or 17 objectives represent the ideal, a partial sampling across families or → an

subfamilies is also possible, and may even become necessary when other factors such as criticality, existing range facilities and ammunition costs are considered.

Use of the methodological approach just described need not be limited to tank crew performance objectives. Test designers working with any well defined performance domain may also find the approach to be a useful and convenient way of treating the issue of generalizability. In the near future, the Army Research Institute will publish a comprehensive report on its efforts to develop a more efficient test of tank gunnery. Related efforts include research to establish the criticality of crew performance objectives, an assessment of the appropriateness of different test scoring procedures and a discussion of the tradeoffs in generalizability, criticality and score quality which are involved in the design of an efficient test of tank crew weapons proficiency.

Table 3. Family I Objectives Ordered by Generalizability

						GUNNERY OBJECTIVE						
OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum F^2/D$**
207	GNR	CX	RCL	STA	MOV	LAV	VAL	5-9	NGT	TEL	762	.67
205	GNR	CX	RCL	STA	MOV	LAV	VAL	5-9	NGT	GPD	762	.60
208	GNR	CX	RCL	STA	MOV	LAV	VAL	5-9	NGT	INF	762	.51
201	GNR	CX	RCL	STA	STA	L/C	VAL	5-9	NGT	GPD	762	.48
203	GNR	CX	RCL	STA	STA	L/C	VAL	5-9	NGT	TEL	762	.48
204	GNR	CX	RCL	STA	STA	L/C	VAL	5-9	NGT	INF	762	.45
209	GNR	CX	RCL	STA	STA	TRP	VAL	5-9	NGT	GPD	762	.28
211	GNR	CX	RCL	STA	STA	TRP	VAL	5-9	NGT	TEL	762	.28
212	GNR	CX	RCL	STA	STA	TRP	VAL	5-9	NGT	INF	752	.25
206	GNR	CX	RCL	STA	MOV	LAV	VAL	5-9	NGT	GPI	762	-.15
202	GNR	CX	RCL	STA	STA	L/C	VAL	5-9	NGT	GPI	762	-.27
210	GNR	CX	RCL	STA	STA	TRP	VAL	5-9	NGT	GPI	762	-.47
200	GNR	CX	RC	STA	STA	LCT	NVS	<900	D/N	AUX	762	-3.12

**Generalizability index values expressed as z-score equivalents.

Table 4. Family II Objectives Ordered by Generalizability

						GUNNERY OBJECTIVE						
OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum F^2/D$
230	TC	50	NP	MOV	MOV	LAV	VAL	<1100	NGT	TPI	50	1.23
229	TC	50	NP	MOV	MOV	LAV	VAL	<1100	NGT	TPD	50	1.16
226	TC	50	NP	MOV	STA	LAV	VIS	<2300	D/N	TPD	50	1.04
227	TC	50	NP	STA	MOV	LAV	VAL	<1100	NGT	TPD	50	.96
228	TC	50	NP	STA	MOV	LAV	VAL	<1100	NGT	TPI	50	.78
225	TC	50	NP	STA	MOV	LAV	VIS	<2300	D/N	TPD	50	.59
224	TC	50	NP	MOV	STA	L/C	VAL	<1100	NGT	TPI	50	.58
223	TC	50	NP	MOV	STA	L/C	VAL	<1100	NGT	TPD	50	.52
222	TC	50	NP	STA	STA	L/C	VAL	<1100	NGT	TPI	50	.14
238	TC	50	NP	MOV	STA	AIR	VIS	<2300	DAY	TPD	50	.11
221	TC	50	NP	STA	STA	L/C	VAL	<1100	NGT	TPD	50	.07
236	TC	50	NP	MOV	STA	TRP	VAL	<1100	NGT	TPI	50	-.10
235	TC	50	NP	MOV	STA	TRP	VAL	<1100	NGT	TPD	50	-.17
232	TC	50	NP	MOV	STA	TRP	VIS	<2300	D/N	TPD	50	-.29
237	TC	50	NP	STA	MOV	AIR	VIS	<2300	DAY	TPD	50	-.33
234	TC	50	NP	STA	STA	TRP	VAL	<1100	NGT	TPI	50	-.42
233	TC	50	NP	STA	STA	TRP	VAL	<1100	NGT	TPD	50	-.49
231	TC	50	NP	STA	STA	TRP	VIS	<2300	D/N	TPD	50	-.61
220	TC	50	NP	MOV	STA	L/C	VIS	<2300	D/N	TPD	50	-2.17
219	TC	50	NP	STA	STA	L/C	VIS	<2300	D/N	TPD	50	-2.61

Table 5. Family III Objectives Ordered by Generalizability within Subfamilies

Subfamily III a

OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
						GUNNERY OBJECTIVE							
153	TC	CX	NP	MOV	MOV	LAV	VAL	<500	NGT	RFI	762	1.58	1.63
152	TC	CX	NP	MOV	MOV	LAV	VAL	<500	NGT	RFD	762	1.26	1.41
149	TC	CX	NP	MOV	MOV	LAV	VIS	<500	D/N	RFD	762	1.26	1.40
147	TC	CX	NP	MOV	STA	L/C	VAL	<500	NGT	RFI	762	.98	1.05
146	TC	CX	NP	MOV	STA	L/C	VAL	<500	NGT	RFD	762	.66	.82
143	TC	CX	NP	MOV	STA	L/C	VIS	<500	D/N	RFD	762	.66	.82
151	TC	CX	NP	STA	MOV	LAV	VAL	<500	NGT	RFI	762	.53	.62
150	TC	CX	NP	STA	MOV	LAV	VAL	<500	NGT	RFD	762	.21	.39
148	TC	CX	NP	STA	MOV	LAV	VIS	<500	D/N	RFD	762	.21	.38
159	TC	CX	NP	MOV	STA	TRP	VAL	<500	NGT	RFI	762	-.08	.01
145	TC	CX	NP	STA	STA	L/C	VAL	<500	NGT	RFI	762	-.34	.21
158	TC	CX	NP	MOV	STA	TRP	VAL	<500	NGT	RFD	762	-.40	-.22
155	TC	CX	NP	MOV	STA	TRP	VIS	<500	D/N	RFD	762	-.40	-.22
144	TC	CX	NP	STA	STA	L/C	VAL	<500	NGT	RFD	762	-.66	-.01
142	TC	CX	NP	STA	STA	L/C	VIS	<500	D/N	RFD	762	-.66	-.02
157	TC	CX	NP	STA	STA	TRP	VAL	<500	NGT	RFI	762	-1.39	-.83
156	TC	CX	NP	STA	STA	TRP	VAL	<500	NGT	RFD	762	-1.71	-1.05
154	TC	CX	NP	STA	STA	TRP	VIS	<500	D/N	RFD	752	-1.72	-1.06

Subfamiliy III b

OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
199	TC	CX	PRE	STA	STA	TRP	VAL	5-9	NGT	RFD	762	.87	-1.85
198	TC	CX	PRE	STA	STA	TRP	VIS	5-9	D/N	RFD	762	.86	-1.86
197	TC	CX	PRE	STA	STA	L/C	VAL	5-9	NGT	RFD	762	-.86	-.81
196	TC	CX	PRE	STA	STA	L/C	VIS	5-9	D/N	RFD	762	-.87	-.82

Table 6. Family IV Objectives Ordered by Generalizability within Subfamilies
(Page 1 of 2)

Subfamily IV a

GUNNERY OBJECTIVE

OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
22	TC	MG	BS	MOV	STA	T/LAV	VIS	<1100	D/N	RFD	SB/HT	1.71	-.95
24	TC	MG	BS	MOV	MOV	T/LAV	VIS	<1100	D/N	RFD	SB/HT	1.65	-.96
28	TC	MG	BS	MOV	STA	T/LAV	VAL	<1100	NGT	RFI	SB/HT	.52	-1.24
27	TC	MG	BS	MOV	STA	T/LAV	VAL	<1100	NGT	RFD	SB/HT	.32	-1.21
30	TC	MG	BS	STA	MOV	T/LAV	VAL	<1100	NGT	RFI	SB/HT	.11	-.57
29	TC	MG	BS	STA	MOV	T/LAV	VAL	<1100	NGT	RFD	SB/HT	-.10	-.54
23	TC	MG	BS	STA	MOV	T/LAV	VIS	<1100	D/N	RFD	SB/HT	-.10	-.55
26	TC	MG	BS	STA	STA	T/LAV	VAL	<1100	NGT	RFI	SB/HT	-.26	-.64
25	TC	MG	BS	STA	STA	T/LAV	VAL	<1100	NGT	RFD	SB/HT	-.47	-.61
32	TC	MG	BS	MOV	MOV	T/LAV	VAL	<1100	NGT	RFI	SB/HT	-.66	-1.45
31	TC	MG	BS	MOV	MOV	T/LAV	VAL	<1100	NGT	RFD	SB/HT	-.87	-1.42
21	TC	MG	BS	STA	STA	T/LAV	VIS	<1100	D/N	RFD	SB/HT	-1.86	-.87

Table 6. Family IV Objectives Ordered by Generalizability with Subfamilies
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Subfamily IV b

GUNNERY OBJECTIVE													
OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
76	TC	MG	PRE	MOV	STA	TRP	VAL	5-32	NGT	RFD	BEE	1.19	1.42
74	TC	MG	PRE	MOV	STA	TRP	VIS	5-32	D/N	RFD	BEE	1.18	1.41
72	TC	MG	PRE	MOV	MOV	B/C	VAL	5-32	NGT	RFD	HEP	.83	1.27
70	TC	MG	PRE	MOV	STA	B/C	VIS	5-32	D/N	RFD	HEP	.83	1.27
75	TC	MG	PRE	STA	STA	TRP	VAL	5-32	NGT	RFD	BEE	.38	.86
73	TC	MG	PRE	STA	STA	TRP	VIS	5-32	D/N	RFD	BEE	.38	.85
71	TC	MG	PRE	STA	STA	B/C	VAL	5-32	NGT	RFD	HEP	.03	.71
69	TC	MG	PRE	STA	STA	B/C	VIS	5-32	D/N	RFD	HEP	.02	.71
68	TC	MG	PRE	MOV	STA	T/LAV	VAL	5-32	NGT	RFD	SB/HT	-.81	.91
66	TC	MG	PRE	MOV	STA	T/LAV	VIS	5-32	D/N	RFD	SB/HT	-.81	.91
67	TC	MG	PRE	STA	STA	T/LAV	VAL	5-32	NGT	RFD	SB/HT	-1.61	.35
65	TC	MG	PRE	STA	STA	T/LAV	VIS	5-32	D/N	RFD	SB/HT	-1.62	.35

Table 7. Family V Objectives Ordered by Generalizability within Subfamilies

Subfamily V a

	GUNNERY OBJECTIVE												
OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
55	GNR	MG	PRE	MOV	STA	B/C	VAL	5-32	NGT	GPD	HEP	1.33	.48
51	GNR	MG	PRE	MOV	STA	B/C	VIS	5-32	D/N	GPD	HEP	1.33	.48
56	GNR	MG	PRE	MOV	STA	B/C	VAL	5-32	NGT	TEL	HEP	.25	-.40
52	GNR	MG	PRE	MOV	STA	B/C	VIS	5-32	D/N	TEL	HEP	.24	-.41
53	GNR	MG	PRE	STA	STA	B/C	VAL	5-32	NGT	GPD	HEP	-.12	-.71
49	GNR	MG	PRE	STA	STA	B/C	VIS	5-32	D/N	GPD	HEP	-.61	-1.15
54	GNR	MG	PRE	STA	STA	B/C	VAL	5-32	NGT	TEL	HEP	-1.21	-1.59
50	GNR	MG	PRE	STA	STA	B/C	VIS	5-32	D/N	TEL	HEP	-1.22	-1.59

Subfamily V b

OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
63	GNR	MG	PRE	MOV	STA	TRP	VAL	5-32	NGT	GPD	BEE	1.31	1.65
59	GNR	MG	PRE	MOV	STA	TRP	VIS	5-32	D/N	GPD	BEE	1.31	1.64
64	GNR	MG	PRE	MOV	STA	TRP	VAL	5-32	NGT	TEL	BEE	.19	.76
60	GNR	MG	PRE	MOV	STA	TRP	VIS	5-32	D/N	TEL	BEE	.19	.76
61	GNR	MG	PRE	STA	STA	TRP	VAL	5-32	NGT	GPD	BEE	-.19	.46
57	GNR	MG	PRE	STA	STA	TRP	VIS	5-32	D/N	GPD	BEE	-.19	.46
62	GNR	MG	PRE	STA	STA	TRP	VAL	5-32	NGT	TEL	BEE	-1.31	-.42
58	GNR	MG	PRE	STA	STA	TRP	VIS	5-32	D/N	TEL	BEE	-1.31	-.42

Table 8. Family VI Objectives Ordered by Generalizability within Subfamilies
(Page 1 of 4)

Subfamily VI a

	GUNNERY OBJECTIVE												
OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
112	GNR	CX	NP	MOV	STA	L/C	VAL	<500	NGT	TEL	762	1.25	.49
104	GNR	CX	NP	MOV	STA	L/C	VIS	<500	D/N	TEL	762	1.24	.48
110	GNR	CX	NP	MOV	STA	L/C	VAL	<500	NGT	GPD	762	1.23	.36
103	GNR	CX	NP	MOV	STA	L/C	VIS	<500	D/N	GPD	762	1.22	.36
113	GNR	CX	NP	MOV	STA	L/C	VAL	<500	NGT	INF	762	1.15	.38
105	GNR	CX	NP	MOV	STA	L/C	VIS	<500	D/N	INF	762	1.15	.38
111	GNR	CX	NP	MOV	STA	L/C	VAL	<500	NGT	GPI	762	1.06	.11
126	GNR	CX	NP	MOV	MOV	LAV	VAL	<500	NGT	TEL	762	.86	.18
118	GNR	CX	NP	MOV	MOV	LAV	VIS	<500	D/N	TEL	762	.86	.17
124	GNR	CX	NP	MOV	MOV	LAV	VAL	<500	NGT	GPD	762	.85	.05
117	GNR	CX	NP	MOV	MOV	LAV	VIS	<500	D/N	GPD	762	.84	.04
140	GNR	CX	NP	MOV	STA	TRP	VAL	<500	NGT	TEL	762	.78	.11
132	GNR	CX	NP	MOV	STA	TRP	VIS	<500	D/N	TEL	762	.77	.10
127	GNR	CX	NP	MOV	MOV	LAV	VAL	<500	NGT	INF	762	.77	.07
138	GNR	CX	NP	MOV	STA	TRP	VAL	<500	NGT	GPD	762	.77	-.02
119	GNR	CX	NP	MOV	MOV	LAV	VIS	<500	D/N	INF	762	.76	.06
131	GNR	CX	NP	MOV	STA	TRP	VIS	<500	D/N	GPD	752	.76	-.03
141	GNR	CX	NP	MOV	STA	TRP	VAL	<500	NGT	INF	762	.69	0
133	GNR	CX	NP	MOV	STA	TRP	VIS	<500	D/N	INF	762	.68	-.01
125	GNR	CX	NP	MOV	MOV	LAV	VAL	<500	NGT	GPI	762	.68	-.20
139	GNR	CX	NP	MOV	STA	TRP	VAL	<500	NGT	GPI	762	.60	-.27
122	GNR	CX	NP	STA	MOV	LAV	VAL	<500	NGT	TEL	762	-.25	-.74

Table 8. Family VI Objectives Ordered by Generalizability within Subfamilies
(Page 2 of 4)

Subfamily VI a

							GUNNERY OBJECTIVE						
OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
115	GNR	CX	NP	STA	MOV	LAV	VIS	<500	D/N	TEL	762	-.26	-.75
120	GNR	CX	NP	STA	MOV	LAV	VAL	<500	NGT	GPD	762	-.27	-.87
114	GNR	CX	NP	STA	MOV	LAV	VIS	<500	D/N	GPD	762	-.28	-.87
123	GNR	CX	NP	STA	MOV	LAV	VAL	<500	NGT	INF	762	-.34	-.85
116	GNR	CX	NP	STA	MOV	LAV	VIS	<500	D/N	INF	762	-.35	-.86
121	GNR	CX	NP	STA	MOV	LAV	VAL	<500	NGT	GPI	762	-.44	-1.12
108	GNR	CX	NP	STA	STA	L/C	VAL	<500	NGT	TEL	762	-.75	-1.12
101	GNR	CX	NP	STA	STA	L/C	VIS	<500	D/N	TEL	762	-.76	-1.13
109	GNR	CX	NP	STA	STA	L/C	VAL	<500	NGT	INF	762	-.86	-1.23
102	GNR	CX	NP	STA	STA	L/C	VIS	<500	D/N	INF	762	-.87	-1.24
106	GNR	CX	NP	STA	STA	L/C	VAL	<500	NGT	GPD	762	-.90	-1.29
100	GNR	CX	NP	STA	STA	L/C	VIS	<500	D/N	GPD	762	-.91	-1.30
107	GNR	CX	NP	STA	STA	L/C	VAL	<500	NGT	GPI	762	-1.07	-1.54
136	GNR	CX	NP	STA	STA	TRP	VAL	<500	NGT	TEL	762	-1.22	-1.51
137	GNR	CX	NP	STA	STA	TRP	VAL	<500	NGT	INF	762	-1.33	-1.61
130	GNR	CX	NP	STA	STA	TRP	VIS	<500	D/N	INF	762	-1.34	-1.62
134	GNR	CX	NP	STA	STA	TRP	VAL	<500	NGT	GPD	762	-1.37	-1.67
135	GNR	CX	NP	STA	STA	TRP	VAL	<500	NGT	GPI	762	-1.54	-1.92
129	GNR	CX	NP	STA	STA	TRP	VIS	<500	D/N	TEL	762	-1.87	-2.08
128	GNR	CX	NP	STA	STA	TRP	VIS	<500	D/N	GPD	762	-2.02	-2.24

Table 8. Family VI Objectives Ordered by Generalizability within Subfamilies
(Page 3 of 4)

Subfamily VI b

						GUNNERY OBJECTIVE							
OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
170	GNR	CX	PRE	MOV	STA	L/C	VAL	5-9	NGT	TEL	762	1.63	1.76
164	GNR	CX	PRE	MOV	STA	L/C	VIS	5-9	D/N	TEL	762	1.62	1.75
182	GNR	CX	PRE	MOV	MOV	LAV	VAL	5-9	NGT	TEL	762	1.21	1.45
176	GNR	CX	PRE	MOV	MOV	LAV	VIS	5-9	D/N	TEL	762	1.20	1.44
171	GNR	CX	PRE	MOV	STA	L/C	VAL	5-9	NGT	INF	762	1.19	1.62
165	GNR	CX	PRE	MOV	STA	L/C	VIS	5-9	D/N	INF	762	1.18	1.61
169	GNR	CX	PRE	MOV	STA	L/C	VAL	5-9	NGT	GPD	762	1.08	1.60
163	GNR	CX	PRE	MOV	STA	L/C	VIS	5-9	D/N	GPD	762	1.07	1.59
194	GNR	CX	PRE	MOV	STA	TRP	VAL	5-9	NGT	TEL	762	.93	1.22
188	GNR	CX	PRE	MOV	STA	TRP	VIS	5-9	D/N	TEL	762	.92	1.21
183	GNR	CX	PRE	MOV	MOV	LAV	VAL	5-9	NGT	INF	762	.77	1.30
177	GNR	CX	PRE	MOV	MOV	LAV	VIS	5-9	D/N	INF	762	.76	1.29
181	GNR	CX	PRE	MOV	MOV	LAV	VAL	5-9	NGT	GPD	762	.65	1.28
175	GNR	CX	PRE	MOV	MOV	LAV	VIS	5-9	D/N	GPD	762	.64	1.27
193	GNR	CX	PRE	MOV	STA	TRP	VAL	5-9	NGT	GPD	762	.42	1.01
187	GNR	CX	PRE	MOV	STA	TRP	VIS	5-9	D/N	GPD	762	.41	1.00
189	GNR	CX	PRE	MOV	STA	TRP	VIS	5-9	D/N	INF	762	.41	1.00
179	GNR	CX	PRE	STA	MOV	LAV	VAL	5-9	NGT	TEL	762	-.03	.53

Table 8. Family VI Objectives Ordered by Generalizability within Subfamilies
(Page 4 of 4)

Subfamily VI b

							GUNNERY OBJECTIVE						
OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
173	GNR	CX	PRE	STA	MOV	LAV	VIS	5-9	D/N	TEL	752	-.04	.52
180	GNR	CX	PRE	STA	MOV	LAV	VAL	5-9	NGT	INF	762	-.46	.38
174	GNR	CX	PRE	STA	MOV	LAV	VIS	5-9	D/N	INF	762	-.48	.38
167	GNR	CX	PRE	STA	STA	L/C	VAL	5-9	NGT	TEL	762	-.50	.15
161	GNR	CX	PRE	STA	STA	L/C	VIS	5-9	D/N	TEL	762	-.51	.14
178	GNR	CX	PRE	STA	MOV	LAV	VAL	5-9	NGT	GPD	762	-.58	.37
172	GNR	CX	PRE	STA	MOV	LAV	VIS	5-9	D/N	GPD	762	-.59	.36
168	GNR	CX	PRE	STA	STA	L/C	VAL	5-9	NGT	INF	762	-.91	0
162	GNR	CX	PRE	STA	STA	L/C	VIS	5-9	D/N	INF	762	-.92	-.01
195	GNR	CX	PRE	MOV	STA	TRP	VAL	5-9	NGT	INF	762	-.96	.79
191	GNR	CX	PRE	STA	STA	TRP	VAL	5-9	NGT	TEL	762	-1.02	-.24
185	GNR	CX	PRE	STA	STA	TRP	VIS	5-9	D/N	TEL	762	-1.03	-.24
166	GNR	CX	PRE	STA	STA	L/C	VAL	5-9	NGT	GPD	762	-1.03	-.06
160	GNR	CX	PRE	STA	STA	L/C	VIS	5-9	D/N	GPD	762	-1.05	-.07
192	GNR	CX	PRE	STA	STA	TRP	VAL	5-9	NGT	INF	762	-1.43	-.38
186	GNR	CX	PRE	STA	STA	TRP	VIS	5-9	D/N	INF	762	-1.44	-.39
190	GNR	CX	PRE	STA	STA	TRP	VAL	5-9	NGT	GPD	752	-1.55	-.44
184	GNR	CX	PRE	STA	STA	TRP	VIS	5-9	D/N	GPD	762	-1.56	-.45

Table 9. **Family VII Objectives Ordered by Generalizability within Subfamilies**
(Page 1 of 2)

Subfamily VII a

OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
	GUNNERY OBJECTIVE												
99	TC	MG	RCL	STA	STA	TRP	VAL	11-32	NGT	TPD	BEE	1.44	1.16
97	TC	MG	RCL	STA	STA	TRP	VAL	<1100	NGT	TPD	BEE	1.16	1.15
92	TC	MG	RCL	STA	STA	T/LAV	VAL	<1100	NGT	TPD	SB/HT	.93	1.24
98	TC	MG	RCL	STA	STA	TRP	VAL	<1100	NGT	TPI	BEE	.20	.51
93	TC	MG	RCL	STA	STA	T/LAV	VAL	<1100	NGT	TPI	SB/HT	.15	.63
239	TC	MG	RCL	STA	MOV	T/LAV	VAL	<1100	NGT	RFD	SB/HT	-.05	1.03
96	TC	MG	RCL	STA	STA	B/C	VAL	11-32	NGT	TPD	HEP	-.56	.36
240	TC	MG	RCL	STA	MOV	T/LAV	VAL	<1100	NGT	RFI	SB/HT	-.66	.57
94	TC	MG	RCL	STA	STA	B/C	VAL	<1100	NGT	TPD	HEP	-.83	.34
95	TC	MG	RCL	STA	STA	B/C	VAL	<1100	NGT	TPI	HEP	-1.79	-.30

Table 9. Family VII Objectives Ordered by Generalizability within Subfamilies
(Page 2 of 2)

Subfamily VII b

	GUNNERY OBJECTIVE												
OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
91	GNR	MG	RCL	STA	STA	TRP	VAL	11-32	NGT	GPD	BEE	.95	.80
78	GNR	MG	RCL	STA	STA	T/LAV	VAL	<1100	NGT	GPD	SB/HT	.80	.58
80	GNR	MG	RCL	STA	STA	T/LAV	VAL	<1100	NGT	TEL	SB/HT	.79	.76
83	GNR	MG	RCL	STA	MOV	T/LAV	VAL	<1100	NGT	TEL	SB/HT	.78	.75
88	GNR	MG	RCL	STA	STA	TRP	VAL	<1100	NGT	GPD	BEE	.69	.69
81	GNR	MG	RCL	STA	MOV	T/LAV	VAL	<1100	NGT	GPD	SB/HT	.48	.52
87	GNR	MG	RCL	STA	STA	B/C	VAL	11-32	NGT	GPD	HEP	.42	.34
90	GNR	MG	RCL	STA	STA	TRP	VAL	<1100	NGT	TEL	BEE	.38	.65
79	GNR	MG	RCL	STA	STA	T/LAV	VAL	<1100	NGT	GPI	SB/HT	.12	.21
82	GNR	MG	RCL	STA	MOV	T/LAV	VAL	<1100	NGT	GPI	SB/HT	-.20	.14
89	GNR	MG	RCL	STA	STA	TRP	VAL	<1100	NGT	GPI	BEE	-.26	.08
84	GNR	MG	RCL	STA	STA	B/C	VAL	<1100	NGT	GPD	HEP	-.35	-.05
86	GNR	MG	RCL	STA	STA	B/C	VAL	<1100	NGT	TEL	HEP	-.67	-.09
85	GNR	MG	RCL	STA	STA	B/C	VAL	<1100	NGT	GPI	HEP	-1.02	-.43
77	GNR	MG	RC	STA	STA	ALL	NVS	ALL	D/N	AUX	HEP	-2.91	-1.76

Subfamily VII c

216	TC	CX	RCL	STA	MOV	LAV	VAL	5-9	NGT	RFI	762	.79	-2.01
215	TC	CX	RCL	STA	MOV	LAV	VAL	5-9	NGT	RFD	762	.77	-1.55
214	TC	CX	RCL	STA	STA	L/C	VAL	5-9	NGT	RFI	762	.51	-1.80
213	TC	CX	RCL	STA	STA	L/C	VAL	5-9	NGT	RFD	762	.50	-1.34
218	TC	CX	RCL	STA	STA	TRP	VAL	5-9	NGT	RFI	762	-1.27	-1.82
217	TC	CX	RCL	STA	STA	TRP	VAL	5-9	NGT	RFD	762	-1.29	-1.36

Table 10. Family VIII Objectives Ordered by Generalizability within Subfamilies
(Page 1 of 2)

OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
						GUNNERY OBJECTIVE							
						Subfamily VIII a							
9	GNR	MG	BS	STA	STA	T/LAV	VAL	<1100	NGT	GPD	SB/HT	.91	-1.41
1	GNR	MG	BS	STA	STA	T/LAV	VIS	<1100	D/N	GPD	SB/HT	.90	-1.42
10	GNR	MG	BS	STA	STA	T/LAV	VAL	<1100	NGT	GPI	SB/HT	.90	-1.60
11	GNR	MG	BS	STA	STA	T/LAV	VAL	<1100	NGT	TEL	SB/HT	.61	-.45
2	GNR	MG	BS	STA	STA	T/LAV	VIS	<1100	D/N	TEL	SB/HT	.60	-.46
17	GNR	MG	BS	STA	MOV	T/LAV	VAL	<1100	NGT	TEL	SB/HT	.13	.59
6	GNR	MG	BS	STA	MOV	T/LAV	VIS	<1100	D/N	TEL	SB/HT	.11	.59
15	GNR	MG	BS	STA	MOV	T/LAV	VAL	<1100	NGT	GPD	SB/HT	-1.38	-.23
5	GNR	MG	BS	STA	MOV	T/LAV	VIS	<1100	D/N	GPD	SB/HT	-1.39	-.23
16	GNR	MG	BS	STA	MOV	T/LAV	VAL	<1100	NGT	GPI	SB/HT	-1.39	-.41
						Subfamily VIII b							
18	GNR	MG	BS	MOV	MOV	T/LAV	VAL	<1100	NGT	GPD	SB/HT	1.21	-.70
7	GNR	MG	BS	MOV	MOV	T/LAV	VIS	<1100	D/N	GPD	SB/HT	1.19	-.71
19	GNR	MG	BS	MOV	MOV	T/LAV	VAL	<1100	NGT	GPI	SB/HT	1.19	-.88
12	GNR	MG	BS	MOV	STA	T/LAV	VAL	<1100	NGT	GPD	SB/HT	.01	-1.07
3	GNR	MG	BS	MOV	STA	T/LAV	VIS	<1100	D/N	GPD	SB/HT	-.01	-1.08
13	GNR	MG	BS	MOV	STA	T/LAV	VAL	<1100	NGT	GPI	SB/HT	-.01	-1.26
20	GNR	MG	BS	MOV	MOV	T/LAV	VAL	<1100	NGT	TEL	SB/HT	-.29	.12
8	GNR	MG	BS	MOV	MOV	T/LAV	VIS	<1100	D/N	TEL	SB/HT	-.31	.11
14	GNR	MG	BS	MOV	STA	T/LAV	VAL	<1100	NGT	TEL	SB/HT	-1.49	-.25
4	GNR	MG	BS	MOV	STA	T/LAV	VIS	<1100	D/N	TEL	SB/HT	-1.51	-.26

Table 10. Family VIII Objectives Ordered by Generalizability within Subfamilies
(Page 2 of 2)

Subfamily VIII c

	GUNNERY OBJECTIVE												
OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
46	GNR	MG	PRE	STA	MOV	T/LAV	VAL	5-32	NGT	TEL	SB/HT	1.32	.94
38	GNR	MG	PRE	STA	MOV	T/LAV	VIS	5-32	D/N	TEL	SB/HT	1.32	.94
42	GNR	MG	PRE	STA	STA	T/LAV	VAL	5-32	NGT	TEL	SB/HT	.09	1.55
34	GNR	MG	PRE	STA	STA	T/LAV	VIS	5-32	D/N	TEL	SB/HT	.08	.15
45	GNR	MG	PRE	STA	MOV	T/LAV	VAL	5-32	NGT	GPD	SB/HT	-.08	-.10
37	GNR	MG	PRE	STA	MOV	T/LAV	VIS	5-32	D/N	GPD	SB/HT	-.09	-.10
41	GNR	MG	PRE	STA	STA	T/LAV	VAL	5-32	NGT	GPD	SB/HT	-1.32	-.88
33	GNR	MG	PRE	STA	STA	T/LAV	VIS	5-32	D/N	TPD	SB/HT	-1.32	-.89

Subfamily VIII d

OBJ NR	CRW MEM	WPN	FIR MOD	VEH MOT	TGT MOT	TGT TYP	TGT VIS	TGT RNG	DAY/ NGT	F/C INS	AMMO	$\sum f^2/D$	$\sum F^2/D$
48	GNR	MG	PRE	MOV	MOV	T/LAV	VAL	5-32	NGT	TEL	SB/HT	1.29	2.25
40	GNR	MG	PRE	MOV	MOV	T/LAV	VIS	5-32	D/N	TEL	SB/HT	1.29	2.24
44	GNR	MG	PRE	MOV	STA	T/LAV	VAL	5-32	NGT	TEL	SB/HT	.42	1.54
47	GNR	MG	PRE	MOV	MOV	T/LAV	VAL	5-32	NGT	GPD	SB/HT	-.10	1.20
39	GNR	MG	PRE	MOV	MOV	T/LAV	VIS	5-32	D/N	GPD	SB/HT	-.11	1.20
36	GNR	MG	PRE	MOV	STA	T/LAV	VIS	5-32	D/N	TEL	SB/HT	-.23	1.45
43	GNR	MG	PRE	MOV	STA	T/LAV	VAL	5-32	NGT	GPD	SB/HT	-1.03	.49
35	GNR	MG	PRE	MOV	STA	T/LAV	VIS	5-32	D/N	GPD	SB/HT	-1.54	.42